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De nombreuses études ont démontré qu'il est possible d'entraîner quelqu'un à développer sa créativité. La présente recherche porte sur l'utilisation du phénomène de l'image consécutive pour favoriser la créativité. L'image consécutive ("afterimage") est la persistance d'une image au niveau de la rétine après la disparition du stimulus externe. La technique de mixage phosphénique utilisée dans cette recherche consiste à associer une pensée ou une image à cette image consécutive. Le présent document contient une revue de la documentation sur la question et les résultats d'une expérimentation.

La recherche a été menés en juillet 1981 auprès de quarante enfants de milieu ouvrier qui fréquentaient deux écoles de Chicoutimi et se répartissaient de la deuxième à la sixième année du primaire; bien qu'il n'y ait pas eu de véritable échantillonnage, le groupe comprenait autant de garçons que de filles. Le premier groupe expérimental a été entraîné selon la méthode de mixage phosphénique du Dr Francis Lefébure; le second groupe a été entraîné à l'aide de diverses techniques de stimulation des idées. La créativité a été mesurée grâce au test de comportement créatif de Torrance.

Cette recherche démontre que le mixage phosphénique, fondé sur l'image consécutive, est une technique valable pour développer la créativité, surtout dans son aspect verbal. De plus, si on la combine à des techniques de stimulation des idées, c'est tout l'ensemble de la créativité qui est amélioré. Ces conclusions semblent confirmer la tendance actuelle à introduire des techniques de visualisation dans les programmes de résolution de problème qui ont trait à la créativité.

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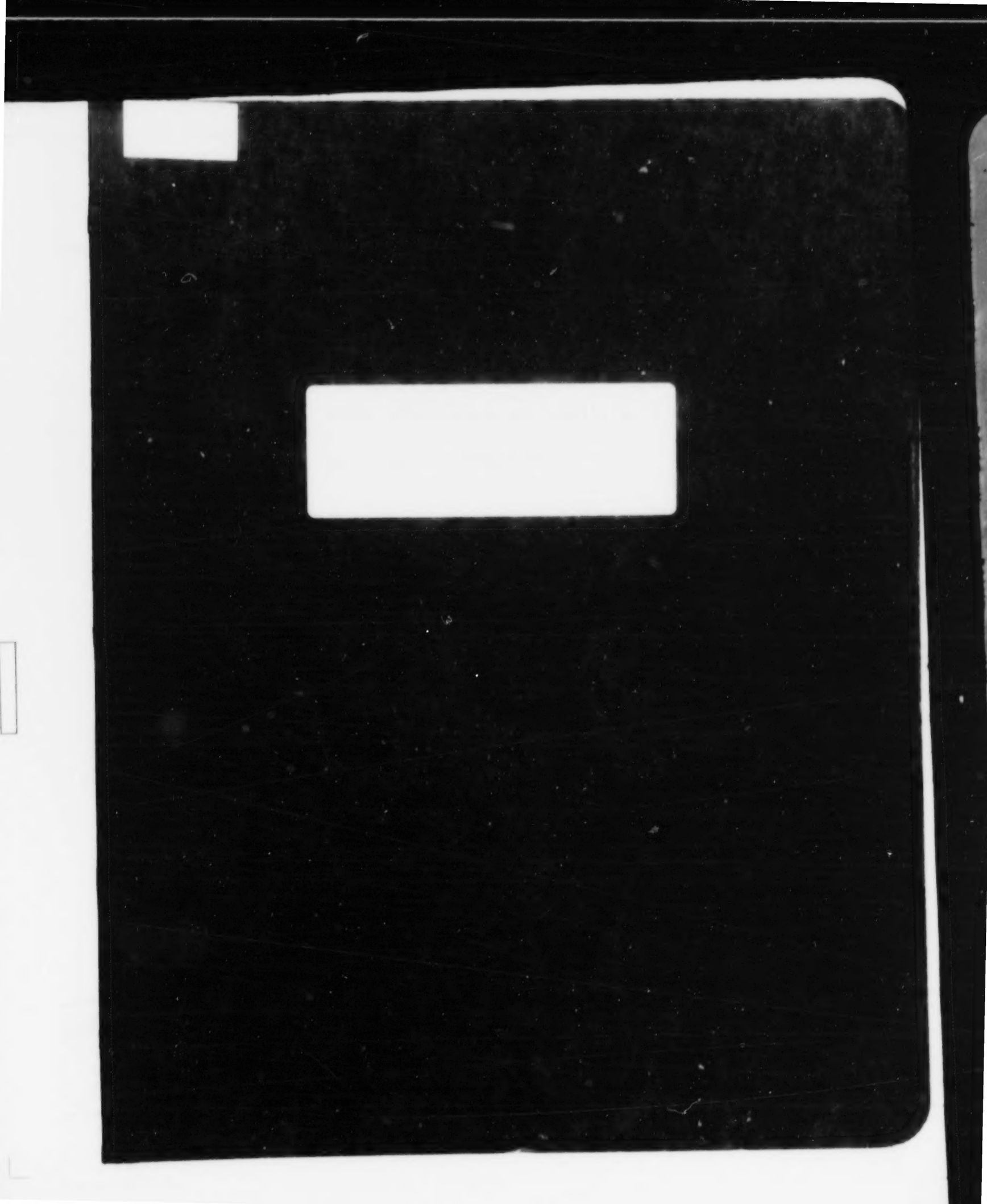

EDUQ 8470651

Visual Afterimagery and Creativity

by

Jacinthe Bédard-Ménard

An Abstract of a Thesis
in
Creative Studies

Submitted in Partial Fulfillment
of the Requirements
for the Degree of

Master of Science

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College at Buffalo
Department of Creative Studies

Abstract

Over the last twenty five years, many studies have proved that it is possible to train people to improve their creative abilities. The Osborn-Parnes Creative Problem-Solving Process and some techniques such as brainstorming, the checklist, forced relationships, the metaphorical approach, to name only a few, have been used very efficiently.

However, there is still room for exploration in the vast field of creativity and the phenomenon of visual afterimagery might open a new path of investigation. The visual afterimage is the persistence of a retinal image after the removal of the external stimulus and the technique of "visual afterimage mixing" consists of mixing a thought or an image with the visual afterimage. Using that technique with children of a working class neighborhood aged from 8 to 12 years old, significant results (1) have been obtained on the verbal aspect of creativity as tested by the Torrance Tests of Creative Thinking. When the visual afterimage was combined with idea-stimulating techniques, creativity as a whole- verbal and figural - was improved. These conclusions must be considered within the limitations of the study.

(1) $p \leq .05$

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FOREWORD

A year ago, I went to a conference at the University of Quebec at Chicoutimi on visual afterimagery given by a French doctor of medicine, Francis Lefebure. He made the audience experience the afterimage effect. Then, he explained that if an idea is mixed with the afterimage, the concentration is better and after a certain number of trials memory and learning abilities improve considerably, as many years of experience have shown. It is usually accepted that attention, concentration, memory and intelligence in general imply convergent thinking. So, I wondered if divergent thinking, to which we refer in creativity, would also be enhanced by using visual afterimage.

I decided with the permission of Dr. Donald J. Treffinger, my thesis supervisor, to conduct a study on the subject of visual afterimagery and creativity. I did not realize how it would be difficult to find relevent references to the subject. The seven data banks consulted[1] produced more than 80 percent of references discussing different variations of the physiological phenomenon.

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(1) Passar, Dissertation Abstracts, Biological Abstracts, Psychological Abstracts, Exceptional Child Education Resources, Medlars, Eric.

I found very few studies however, in which relations were made between visual afterimage and other fields of study.

I wondered for a while if I could continue working on the subject of visual afterimagery and creativity because of the paucity of references and also because I could not use electroencephalographic instruments. (The latter problem is due to budget cuts at the University of Quebec at Chicoutimi and also at the Hospital in Chicoutimi). As stated in Webster's Dictionary, the afterimage is "a usual visual sensation occurring after the external stimulus causing it has ceased to operate". Until now this phenomenon has been studied mainly in its physiological components. However, a few investigators established correlations between afterimage production and mental health. Moreover, trials have been made to introduce afterimagery empirically in education.

Research by Barry and Beh (1976) indicates that the brainwaves of subjects experiencing visual afterimage are the same as those of people who are waking or who are coming back from a state of meditation. Could this mean that visual afterimage might induce incubation,(1)

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(1) "Incubation is a facilitation of thinking that is evident after an interval during which no conscious work was done on the task (assuming an earlier period of substantial conscious work)."— R.M. Olton, "Experimental Studies of Incubation: Searching for the Elusive." The Journal of Creative Behavior, vol 13, no 1, first quarter, p. 13.

a phase that seems very important in the creative process.

However, after meeting with two ophthalmologists, I thought it would be worth continuing my research since they assured me there was no doubt about the existence of the afterimage phenomenon. In ophthalmology, the afterimage is used for testing in strabism cases and in the treatment of amblyopia. Because of this, I will not control the phenomenon of the afterimage experimentally. I will take into account a certain amount of research on the afterimage and test only the effect of this phenomenon on creativity.

I am grateful to Dr. Christian Poirel, a neuropsychiatrist who agreed to discuss the neurophysiological aspect of the visual afterimage and also to my dear friend, Dr. Bernadine Mc Creesh who encouraged me to pursue with my study. I also wish to thank Louis-Philippe Boucher and his research assistant, Jacques Ouellet, who helped me with the computerized statistical data analyses, as well as Camille Simard, computer analyst, whose opinions were extremely valuable.

INTRODUCTION

Over the last twenty five years, many studies have proved that it is possible to train people to improve their creative abilities. The Osborn - Parnes Creative Problem - Solving Process and some techniques such as brainstorming, the check-list, forced relationships, the metaphorical approach,[1] to name only a few, have been used very efficiently.

However, there is still room for exploration in the vast field of creativity and the phenomenon of visual afterimagery might open a new path of investigation.

As Olton says, "..., experimental evidence in support of incubation is extremely slim. Many of the studies which had reported positive results turned out to have serious - and sometimes lethal - flaws that made their "evidence" of incubation highly questionable."[2] It would be very interesting to check the evidence of incubation in afterimage. Unfortunately, because of technical problems this study will be limited to the effect of visual afterimagery on creativity.

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(1) Have an Affair with your Mind, The Creative Education Foundation, Great Neck, 1974, 48 p.

(2) R.M. Olton, Op. cit., p. 15.

I. CRITICAL ANALYSIS OF THE LITERATURE

1. Definition and Explanation of the Visual Afterimage Phenomenon.

The visual afterimage is the persistence of a retinal image after the removal of the external stimulus.

N.J. Wade explains the phenomenon of afterimage in these terms:

> Afterimages can be seen following either brief, intense illumination of the eye or prolonged fixation on an illuminated stimulus. They have their origin in the bleaching of photochemical pigments within the receptors, and they can be seen during the period of pigment regeneration. The duration for which an afterimage remains visible depends on the previous state of adaptation of the eye, the intensity of the inducing or primary stimulus, and the viewing conditions.(1)

Distinctions have been made between positive afterimage and negative - or complementary - afterimage depending on whether the hue of the chromatic image is the same or the reverse (complementary) as the one appearing in the original image. Slight distinctions have also been made by a few discoverers who have given their names to their discovery. (Hering, Hess and Purkinje).

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(1) N.J. Wade, "Why Do Patterned Afterimages Fluctuate in Visibility", Psychological Bulletin, 1978, vol. 85, no 2, p. 338.

2. Studies on the Physiological Aspect of Visual Afterimage.

To give an idea of the kind of research that has been done on the physiological aspect of visual afterimage, here are some of the subjects studied:

- stimulus duration and intensity, negative afterimage
- retinal adaptation and lateral inhibition, color contrast afterimage
- visual nervous system, temporal properties
- binocular rivalry, binocular interaction
- orientation, duration and frequency of lines comprising configurations
- interaction between contour detectors and columns inhibition, fluctuations of patterned afterimages in visibility
- the after-effect of tracking eye movements
- right hemispheric sensitivity for the McCollough effect
- visual contingent after-effects involving color and contour, McCollough effect.

3. McCollough Effect.

According to the number of abstracts where the McCollough effect is noted, it is certainly the orientation searchers have studied the most in relation to the phenomenon of afterimagery. Skowbo, Timney, Gentry and Morant report, in the Psychological Bulletin, the way McCollough did his experiment:

> In 1965 McCollough reported a color after-effect which was dependent on the orientation of lines and could persist for an hour or more. It was produced by exposing subjects to a grating of vertical black stripes on an orange background, which alternated every few seconds with a horizontal grating on a blue ground. After 2 to 4 minutes, when subjects viewed a test display of black and white vertical and horizontal gratings side by side, most of them reported seeing a desaturated blue green on the background of the vertical lines and orange on the horizontal portion. These colors would exchange places on the gratings if the test stimuli or the subjects head were rotated 90 degrees, disappearing altogether at approximately 45 degrees. (1)

In studies McCollough effects that followed McCollough's first experiment, the characteristics and variations of the physiological phenomenon are merely examined and recorded; they are not related to other phenomena.

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(1) D. Skowbo, B.N. Timney, T.A. Gentry, R.B. Morant, "McCollough Effects: Experimental Findings and Theoretical Accounts", Psychological Bulletin, 1975, vol 82, no 4, p. 497.

4. Visual Afterimage dans Mental Health.

J. Gudmund Smith and his colleages established correlations between the persistence of afterimages and mental health. Using a serial visual afterimage test, and a psychiatric mental status scale, "subjects with high psychotic scores showed one or more regressions to immature /.../ images typical of children who cannot clearly distinguish their afterimages as subjective phenomena distinct from the outside world. It is concluded that the afterimage test indicates schizophrenics to be characterized by intermittent withdrawal into a world where the self and nonself are not clearly distinguished. /However/ regressions were rare in the control groups."(1)

Smith and his team also noticed a successive reduction of afterimage size and stereotyped repetitions of incorrect reports in children and adolescents having depressive tendencies.

A study of Hill and Silverman (1978) shows that mentally retarded children judged stimuli of 20 and 5 msec to be of shorter duration than did normal subjects which suggests a difference in perceptual processing.

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(1) J. Smith Gudmund, Lena Sjoholm, Soren Nielzen, "Explorations in Anxiety and Defense Against Anxiety by Means of two Percept-Genetic Techniques", Psychological Research Bulletin, 1971, vol 11, no 4, Abstract.

5. Visual Afterimage and Intellectual Processes.

Peter Dun-Rankin of the University of Hawaii carried out an experiment in which he tried to determine readers' focal points when viewing printed material so as to find indications of effective letter and word identification. Afterimages formed by a spot of light helped to determine the focal points and to fix the readers' visual attention. The afterimage was then superimposed on letters, words and phrases.

According to Dun-Rankin, all "| his | studies suggest peripheral unconcious control of focalization."(1)

Surprisingly, Dr. Lefebure relates cases in his books where children with learning disabilities learned to spell quite quickly, using the afterimage. Unlike the readers in Dun-Rankin's experiment the children (sometimes assisted) spelled the word, formed an afterimage in their mind, and then respelled the words.

In his book entitled, Le Mixage phosphénique en pédagogie, Dr. Lefebure gives cues for improving attention and memory, and even for solving problems by what could be translated as "afterimage mixing" (2) meaning that a thought or an image is mixed with the afterimage.

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(1) Peter, Dun-Rankin, "Using Afterimages in the Analysis of Letter and Word Focalization", Journal of Reading Behavior, 1977, vol 9, no 2, p. 121.

(2) In French, the expression is called mixage phosphénique, the word phosphène being used as a neologism for postimage.

6. Visual Afterimage and Incubation.

In his books, Dr. Lefebure says that visual afterimagery creates a state of rest that permits the individual to reach his subconscious capabilities. Gowan (1979), Masters and Houston (1972), Wenger (1979) and a few others suggest different conditions for facilitating the subconscious retrieval of images. These conditions can go from daydreaming, fantasy and relaxation to hypnogogic states.

Like Olton, I think experience has shown incubation exists but no objective evidence of it. Such evidence could probably be obtained by an electroencephalogram. The only research to date on visual afterimagery that indicates an electroencephalographic modification was that carried out by Barry and Beh in Australia. According to them "findings indicate that visual afterimages are a significant determinant of the duration of EEG alpha desynchronization following visual stimulus". (1) As previous research has shown, this state of transition from alpha brain-waves to beta brain-waves occurs when a person goes from a state of sleeping to a state of wakefulness, and also from a state of meditation to a normal one.

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(1) Robert J., Barry, Helen C. Beh, "EEG Correlates of the Afterimage of Visual Stimulation", Psychophysiology, 1976, Jan., vol 13, no 1, Abstract.

As I said before, experimental research on incubation possibly induced by visual afterimagery would be of great interest but without access to scientific instruments such a study would be too speculative.

What I intend to study therefore is the effect of visual afterimagery on creativity, to find out whether the use of afterimagery will help or hinder the creative process.

II. EXPERIMENTAL RESEARCH

1.1 Statement of the Problem

Don Taylor, in an article in The Journal of Creative Behavior, asserts that the fact that "attempts to gain insight into the creative process have been so unsuccessful suggests that they have overlooked at least one basic ingredient in the process" (1) and advances the hypothesis that this ingredient is visualization. (2) He adds that many inventors have demonstrated an ability to think in what he calls manipulable visualizations--an ability to juggle with ideas or thoughts.

Ten years after Don Taylor had written his article on functional visualization, Paul Torrance stated that:

> Despite the recent upsurge of interest in the meditative disciplines (Gowan, 1974, 1975; Krippner, 1972, 1979; Orme-Johnson & Farrow, 1977; Cowger & Torrance, 1979), disciplined creative problem-solving practitioners have paid scant attention to the practice of abilities related to internal perspective of visualization. (3)

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(1) Don Taylor, "Creative Design through Functional Visualization," The Journal of Creative Behavior, 1969, vol. 3, no. 2, p. 122.

(2) The following expressions are also used to mean visualization: internal imagery, eidetic imagery, thinking in visual images.

(3) E. Paul Torrance, The Search for Satori and Creativity, Creative Education Foundation and Creative Synergetic Associates, Great Neck, 1973, p. 168.

The main objective of this research is to make an attempt to bridge this gap. The experiment relies on training in creative studies rather than in the arts or in psychotherapy, which have been used by most of those interested in expressive creativity. By conducting research on visual afterimagery and creativity, it is hoped that a contribution can be made to the introduction of a new technique of visualization as an idea-stimulating tool. This technique could be called "visual afterimage mixing", which is a free translation of mixage phosphénique , a term used by a French doctor, Francis Lefébure. (1)

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(1) In this study, "visual afterimage" actually refers to visual afterimage mixing, meaning that a thought or an image is mixed with the visual afterimage. Unless specified otherwise, the physiological or descriptive aspects of the phenomenon will not be discussed.

1.2 Hypotheses(1)

A. All the experimental groups will give significantly more positive results on the post-test than the control group.

B. Each group trained in visual afterimage mixing will give significantly more positive results than the group trained in other idea-stimulating techniques.

C. The group trained in both afterimage mixing and idea-stimulating techniques will give significantly more positive results than the group trained only in visual afterimage mixing.

D. There will be a significant difference between boys and girls on the post-test vis-à-vis the pretest.

E. Experimental groups will give significantly more positive results on the post-test vis-à-vis the pre-test.

(1) These research hypotheses will be converted into null hypotheses in the next part of the study for the purpose of the statistical analysis.

2. Research Procedures

2.1 Nature of the Sample

2.1.1 Population studied.

Forty children from a working-class neighborhood began the experiment. Their ages ranged from 8 to 12, and all of them had completed at least second grade. They were from two different schools, Saint-Coeur-de-Marie for the younger children (grade 2) and Saint-Antoine for the older ones (grades 3, 4, 5 and 6).

2.1.2 Sampling

Since the children participating in the experiment were attending a day camp in the parish of Saint-Antoine, the sampling could be called an accidental one (1), even though the children had been randomly divided into four equal subgroups with equal numbers of boys and girls whose mean age differed by only .04.

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(1) "In accidental sampling, one simply reaches out and takes the cases that fall to hand, continuing the process until the sample reaches a designated size"--Claire Seiltic, Marie Jahoda, Morton Deutsch, Stuart W. Cook, Research Methods in Social Relations, Holt, Rinehart and Winston, U. S. A., 1963, p. 516.

(2) In a simple random sample, not only is the selection of every possible population of the desired number of cases equally likely, but each element in the population has an equal chance of being included in the sample.

2.2 Variables

2.2.1 Independent Variables

The independent variables are the techniques with which we intend to train the children. These techniques are visual afterimage mixing on the one hand, and idea-stimulating techniques (brainstorming, check-list and forced relationship) on the other.

2.2.2 Dependent Variables

The dependent variables are related to the effects of the training on creative behavior as illustrated by Torrance's tests of Creative Behavior that evaluate Guilford's divergent thinking factors: fluency, flexibility, originality and elaboration. (1)

2.2.3 Intermediate Variables

The intermediate variables characterize the subjects and the experimental environment. These variables are not manipulated by the researcher but they influence the reults of the experiment to a certain degree.

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(1) Paul Torrance, "Examples and Rationales of Test Tasks for Assessing Creative Abilities," in Assessing Creative Growth. Test-book one defines these factors in the following terms: "fluency /is/ the number of different relevant ideas, flexibility /is/ the number of shifts in thinking or different categories of responses, originality /is/ the number of statistically infrequent responses that show creative intellectual energy, and elaboration /is/ the number of different ideas used in working out the details of an idea." p. 60.

The only intermediate variables to be considered in this study are chronological age and sex. However, since the experiment is being conducted in a day camp, the environment will probably have an influence that cannot be controlled in the experiment.

2.3 Data Collection Techniques

For the data collection we use the figural and verbal Torrance tests of creative thinking, form A. In the figural form, fluency, flexibility, originality and elaboration are evaluated, while in the verbal one the first three factors, but not the last, are assessed.

There are three tasks to perform on the verbal test. The picture construction activity

> sets in motion the tendency toward finding a purpose for something that has no definite purpose and to elaborate it in such a way that the purpose is achieved. /. . ./ The Picture Completion task calls into play the tendency toward structuring and integrating /... ./ The Repeated Closed Figures task /. . ./ brings into play the tendency toward disruption of structure in order to create something new. (1)

The verbal test includes seven tasks of which three are considered Ask-and-Guess Activities (ask questions, guess causes and guess consequences):

> It can be said that the Ask Activity is designed to reveal the individual's ability to sense what he cannot find out from looking at the picture and to ask questions that will enable him to fill in the gaps in his knowledge. The Guess Causes and Guess Consequences Activities are designed to reveal the subject's ability to formulate hypotheses concerning cause and effect. (2)

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(1) Ibid., p. 62.

(2) Paul Torrance, Torrance Tests of Creative Thinking, Norms-Technical Manual, Princeton, 1966, p. 10.

> The Product Improvement Task calls for the production of clever, interesting, and unusual ways of changing a toy stuffed animal so that it will be more fun for children to play with. The Unusual Uses Task tests the ability to free one's mind of a "well-established" set by asking for unusual and interesting uses of common objects. For the Just Suppose Activity the subject must imagine as many consequences as possible to respond to the improbable situation that is presented to him. (1)

Since the Unusual Questions Activity was too difficult for most of the subjects studied at the pretest to understand, it was avoided.

It is important to note that the administration of the test is made as non-threatening as possible and subtests are even presented as games. The figural test takes 30 minutes to administer and the verbal test 45 (35 in our study).

Since the population studied is French speaking, other French studies were examined. In one article Laurence Rieben mentions that she used Torrance's categories but constructed her own scale for originality. (2) Alain Beaudot made his own categories slightly different from Torrance's and gave a few indications concerning originality. (3) Samuel Amégan also made up a different elaboration scale and

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(1) Assessing Creative Growth, p. 58.

(2) Intelligence et pensée créative, Delachaux et Niestlé, Neucnâtel, 1978.

(3) In E. P. Torrance, Tests de pensée créative, Centre de psychologie appliquée, Paris, 1972, pp. 27-37.

flexibility categories. (1) In this project it seems more convenient to use Torrance's flexibility categories as well as his elaboration scale. It is neverthless regrettable that no data in French were valid enough to be used on a large scale. (Amégan's is the best attempt in this direction, since he has a research population of 200 subjects.)

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(1) K. S. Amégan, "Etude du retentissement de l'organisation pédagogique sur le développement de la pensée créative au niveau de l'école élémentaire," unpublished doctoral dissertation, Université libre de Bruxelles, Brussels, 1977.

2.4 Research Design

2.4.1 Training with Visual Afterimage Mixing--First Experimental Group

The experiment with the visual afterimage mixing is a slight variation on what Dr. Francis Lefébure presents in his book Le Mixage phosphénique en pédagogie (Post-Image Mixing in Education) in the chapter entitled, "Le mixage en cascade dans le but d'avoir davantage d'idées pour une narration ou une dissertation." (1)

Before the experiment the subjects are given an object to think about, for example, the most wonderful house or the most interesting vehicle they can imagine. Then they are asked to look at a light bulb for approximately 30 seconds. After that they close their eyes and think of the thought conjured up while they stare internally for approximately three minutes at the colored spot created by looking at the light bulb (the visual afterimage). No indications are given to the subjects on what visual or auditory images are to be put in the afterimage.

For a group it is useful to have a photographic lamp with a 75-watt light bulb with the subjects positioned from 40 centimetres to two metres away from it. It is preferable for the room to be dark; otherwise people can close their eyes and cover them with a

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(1) Cascade mixing for the purpose of producing more ideas in narration or dissertation.

headband or their hands without exerting any pressure on their eyes.

Lefébure suggests repeating the same experiment a few times, each time using the new ideas that have come up. In our experiment, however, the children preferred to change the object of thought each time.

The subjects are invited to write down the ideas that have come into their minds because they might lose them as quickly as they got them. After that they may express them verbally if they wish.

2.4.2 Training with Idea-stimulating Techniques--Second Experimental Group

The techniques used for training are brainstorming, Osborn's checklists, forced relationships.

Brainstorming is used as the main technique. In fact, the major principle of deferred judgment is applied throughout the whole experiment, and Osborn's basic rules for brainstorming--i.e. criticism is ruled out; free-wheeling is welcome; quantity is wanted; combinations are desirable-- are respected. For example, the subjects are asked to think of as many uses as possible for a pencil.

Osborn's checklist, as given in Applied Imagination, is an idea stimulating list of verbs. These verbs are: put to other uses, modify, magnify, minify, substitute, rearrange, reverse, combine.

Forced relationships is "another fundamental procedure" which consists"/of taking/ anything in one's awareness and /attempting/ to relate it to the problem at hand." (1) For example, subjects can be asked to find ways of improving a lamp by forcing a relationship between it and a globe (atlas).

Finally, "just suppose" techniques take their inspiration from Torrance's books. This technique consists of presenting improbable events and asking subjects what would happen if this event actually occurred.

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(1) Sidney J. Parnes, "Idea-Stimulating Techniques," Guide to Creative Action, Charles Scribner's Sons, New York, 1977, p. 193.

2.4.3 Training with Idea-Stimulating Techniques and Visual Afterimage Mixing--Third Experimental Group.

The third group receives both types of training described in the last two sections.

2.4.4 Tests and Duration of the Experiment.

The pre-tests were done on July 7, 1981, for the figural form and on July 8 for the verbal form.

The experiments started on July 9 and finished on July 22. In other words, the children were trained for two weeks for 45 to 60 minutes a day for the visual afterimage group and the idea-stimulating techniques group. The group receiving both types of training stayed part of the time with the afterimage group and part of the time with the other experimental group. They were trained for between 60 and 75 minutes a day.

2.5 Method of Statistical Analysis

To compensate at least partially for the effect of hazard due to our relatively small sampling, the T-test which consists of a "comparison of sample means" will be applied.(1)

The large group is divided into four equal subgroups. The first one is trained with visual afterimage mixing only; the second one is trained with idea-stimulating techniques; the third one is trained in both visual afterimage mixing and in idea-stimulating techniques and the fourth one is the control group. All the subjects take a pre-test and a post-test and fluency, flexibility, originality and elaboration are considered for both the verbal and the figural tests.

First, to see the representivity of the sampling, an analysis is made to check if the subgroups are comparable, that is if they do not show any significant difference from each other.

Secondly, the means of each of the subgroups at the pre-test are compared to those of the same subgroups at the post-test.

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(1) H. N. Nie, H.C. Hull, Jean Jenkins, Karin Steinbrenner, D. H. Bent, Statistical Package for the Social Sciences, McGraw Hill, U.S.A., 1970, p. 267.

Thirdly, the results of each subgroup at the post-test are compared to one another, for all the subtests taken separately as well as for the mean of the figural form, the verbal form and the grand total of the two of them. To make this last analysis more precise, the raw scores are converted into standardized scores according to the T-Score Conversion Table for Fluency, Flexibility, Originality, and Elaboration on thefigural form A and the verbal form A of the Torrance Tests of Creative Thinking based on fifth grade data. (1)

Finally, complementary ststistics are made regarding the sex of the children participating in the experiment.

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(1) E. P. Torrance, Torrance Tests of Creative Thinking,Norms-Technical Manual,-- Verbal Tests, Forms A and B, Figural Tests, Forms A and B-- Personnel Press, Princeton, pp. 61,67.

3. Analysis and Interpretation

It is important to note that the results that will be presented must be considered within the limits of the study. In spite of these limits, the results may offer interesting indications with regard to the improvement of creativity in children.

3.1 Limitations of the Study.

1° The Sampling: At the beginning, the 40 children who took the pre-test had been carefully divided into four equal subgroups which had the same characteristics of sex and age. However, because it was vacation time and because the participation of the children in the daycamp was not obligatory, many of them left and at the end of the experiment, there were only 22 of the children who had started the experiment. The mean age remained about the same, but there were unequal numbers of children in each group, two having 6 children and the two others 5 and the number of girls and boys in each group being also unequal.

TABLE 1

	Group A	Group B	Group C	Group D
Mean Age	10.1	9.5	9.4	9.4
Boys	3	4	1	2
Girls	2	2	5	3

Group A: trained in visual afterimage mixing.
Group B: trained in idea-stimulating techniques.
Group C: trained in visual afterimage mixing and idea-stimulating techniques.
Group D: control group.

The limits due to the sampling have been partly overcome by using statistical means adapted to such conditions. So, the T-tests which are generally used for small samplings have been done and it has been possible to work with data coming from unequal groups by finding the F value.(1)

2° The Duration of the Study: Two weeks is very short for an experiment even though it is intensive. However, this particular limit may be an advantage for the purpose of the study since creativity training when not introduced in a regular classroom program is often short.

3° The Experimental Setting: Except for the pre-test, which was taken in a school library, all the experiment was done in a room where there were no chairs and no tables. This room was next to a larger room where the daycamp children were playing rather noisily.

Finally, the vacation context with its play atmosphere certainly influenced the experiment in a way that cannot be measured in the study.

Bearing in mind all the limitations indicated above, an attempt will be made to give valuable interpretations of the results obtained.

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(1) The pre-test of the children who were absent from the post-test are not considered here.

3.2 Analysis and Interpretation of the Results (1)

3.2.1 Statistical Analysis of the Results

Null hypothesis A: There will be no significant difference between the experimental groups and the control group on the post-test.

TABLE 2

	MEAN	F VALUE	T VALUE	2 TAIL PROB.	
Group A / Group D					N.S.
Group B / Group D					N.S.
Group C / Group D					
Elaboration 3F *	15.333 5.4000	1.96	2.33	.045	S.
Fluency TV *	33.167 20.200	3.67	2.43	.038	S.
Flexibility 3V	5.5000 2.6000	7.88	2.44	.037	S.
Flexibility TV	33.167 20.200	3.67	2.43	.038	S.
Originality 2V	7.6667 1.2000	11.21	2.51	.046	S.

S $\leq$ .055

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(1) The pre-test shows that the four subgroups are similar since there is no significant difference between any of them except for the third group which performs higher than the control group on the Product Improvement Task for fluency and originality.

Groups A & C / Group D					
Fluency 2V	8.2727 2.8000	80.003	2.39	.036	S.
Flexibility 2V	4.0000 2.2000	27.00	2.47	.029	S.
Originality 1V	7.8182 .40000	78.20	3.07	.011	S.
Originality 2V	8.0000 1,2000	13.94	3.14	.008	S.
Originality TV	62.818 29.200	16.87	2.40	.034	S.

S ≤ .055

*F means Figural Tasks
1F:Picture Construction
2F:Figure Completion
3F:Repeated Closed Figures
T: Total

*V means Verbal Tasks
1V:Asking Questions
2V:Guessing Causes
3V:Guessing Consequences
4V:Product Improvement
5V:Unusual Uses
6V:Just Suppose
T: Total

As this table indicates, there is no significant difference between the group that had training in either visual afterimage mixing (group A) or idea-stimulating techniques (group 2) compared to the control group. However, as the table on intergroup comparisons on the post-test (in appendix) indicates, the groups that had training have a tendency to perform better.

Groups A, B & C / Group D					
Fluency 2V	6.4118 2.8000	64.30	2.16	.044	S.
Flexibility 2V	3.4118 2.2000	25.66	2.07	.052	S.
Flexibility 3V	4.0588 2.6000	7.42	2.04	.056	N.S.
Originality 1V	7.4706 .40000	81.58	3.54	.003	S.
Originality 2V	5.6471 1.2000	12.65	2.56	.019	S.
Originality TV	52.946 29.200	14.24	2.19	.041	S.
Group B & C / Group D					N.S.

S ≒ .055

There are a few statistical differences between the group that was trained in both idea-stimulating techniques and visual afterimage mixing and the other groups. Moreover, in comparison with the control group, the three experimental groups taken as a whole made especially obvious gains in the verbal aspect.

To check if this improvement is due mainly to the idea-stimulating techniques or to the visual afterimage mixing, other T tests were run. Compared to the control group, group B (trained with idea-stimulating techniques) and group C (trained with idea-stimulating techniques and visual afterimage mixing) showed no significant difference. However, gains were still apparent in verbal creative abilities when group A (trained with visual afterimage techniques) and group C (trained with visual afterimage mixing and idea-stimulating techniques) were compared to the control group.

Null hypothesis B: There will be no significant difference between the two groups trained in visual afterimage mixing and the one trained in other idea-stimulating techniques on the post-test.

TABLE 3

	MEAN	F VALUE	T VALUE	2 TAIL PROB.	
Group A / Group B					N.S.
Group B / Group C					
Fluency TV	19.000 33.167	2.65	-2.76	.020	S.
Flexibility 5V	4.8333 7.6667	2.23	-2.83	.018	S.
Flexibility 6V	2.3333 5.8333	2.53	-2.60	.026	S.
Flexibility TV	19.000 33.167	2.65	-2.76	.020	S.
Originality 2V	1.3333 7.6667	6.11	-2.40	.037	S.
Originality 3V	3.0000 9.6667	5.67	-2.29	.045	S.

S ≤ .055

As this table indicates, there is no significant difference between the group that has been trained only in visual afterimage mixing (group A) and the one trained in idea-stimulating techniques (group B). However,

there are significant differences between the group that had training in idea-stimulating techniques and the one that had both types of training. These differences are only in the verbal aspect.

Null hypothesis C: There will be no significant difference between the group trained in afterimage mixing and idea-stimulating techniques (group C) compared to the one that had training in visual afterimage mixing (group A).

TABLE 4

Group C / Group A	N.S.
S ≤ .055	

The T test reveals no difference between group A and C. However, intergroup comparisons in the appendix show that the results of the group trained in idea-stimulating techniques and visual afterimage mixing are better in most cases.

Null hypothesis D: There will be no significant difference between boys and girls on the post-test vis-a-vis the pre-test.

TABLE 5

	MEAN	F VALUE	T VALUE	2 TAIL PROB.	
Boys / Girls					
PRE-TEST					
Flexibility 2F	7.0000 8.5000	1.73	-2.45	.024	S.
Flexibility TF	15.700 20.583	2.09	-2.32	.031	S.
POST-TEST					
Fluency TF	23.700 30.750	1.09	-2.80	.011	S.
Flexibility 2F	7.1000 8.7500	2.97	-2.91	.009	S.
Flexibility 3F	10.500 16.000	1.37	-3.03	.007	S.
Flexibility TF	17.400 24.750	1.14	-4.21	.000	S.
Originality 1F	4.5000 2.6667	4.49	2.74	.015	S.
Originality 3V	3.4000 8.9167	4.77	-2.19	.043	S.
Flexibility 1V	2.8000 4.4167	1.17	-2.10	.048	S.

S = .055

The results actually show significant differences between boys and girls on the post-test vis-a-vis the pre-test. These differences appeared significant in the pre-test only for figural flexibility. These differences are mainly in the figural aspect.

TABLE 6

	MEAN	F VALUE	T VALUE	2 TAIL PROB.	
Post-test / Pre-test					
BOYS					
Originality 3F	26.600 14.700	2.64	2.38	.029	S.
Originality TF	39.400 27.100	2.64	2.38	.029	S.
GIRLS					
Fluency 3F	20.750 14.167	1.60	2.46	.022	S.
Fluency TF	30.750 23.750	1.84	2.50	.020	S.
Flexibility 3F	16.000 12.083	1.96	2.01	.057	N.S.
Flexibility TF	24.750 20.783	2.01	2.10	.047	S.
Originality 3F	34.500 21.167	1.58	2.45	.023	S.
Originality TF	47.583 32.167	1.57	2.64	.015	S.

S $\leq$ .055

The pre-test—post-test comparison for boys and girls taken separately shows that boys have improved their performance only for the figural originality whereas girls have improved significantly three dimensions of their figural abilities: fluency, flexibility and originality.

Null hypothesis E: There will be no significant difference between the post-test vis-a-vis the pre-test for the experimental groups.

TABLE 7

	MEAN	F VALUE	T VALUE	2 TAIL PROB.	
Group A					N.S.
Group B					
Fluency 3F	18.167 11.500	2.04	2.21	.051	S.
Fluency TF	27.167 20.667	1.44	2.14	.058	N.S.
Originality 3F	29.833 15.500	2.14	2.36	.040	S.
Originality TF	42.167 26.667	4.01	2.73	.021	S.
Group C					
Originality TF	47.833 30.333	1.44	2.11	.061	N.S.
Elaboration 3F	15.333 7.3333	3.55	2.17	.055	S.

Groups A, B and C

Fluency 3F	18.529 13.176	1.19	2.26	.031	S.
Fluency TF	28.176 22.235	1.14	2.34	.025	S.
Originality 1F	3.7059 2.1176	1.56	2.48	.018	S.
Originality 3F	31.471 19.412	1.71	2.55	.016	S.
Originality TF	45.000 30.941	1.58	2.85	.007	S.

S ≤ .055

COMPARISON BETWEEN POST-TEST AND PRE-TEST

Table 8

FIGURAL TOTAL (1)

	Difference Mean	Standard Deviation	T Value	2 - Tail Prob.	
Groupe A	2.2500	8.9443	.56	.604	N.S.
Groupe B	8.7500	11.699	1.83	.126	N.S.
Groupe C	11.583	10.609	2.67	.044	S.
Groupe D	7.2500	6.3369	2.56	.063	N.S.

S ≤ .055

(1) Standardized scores are used here, Cf. E.P. Torrance Torrance Tests of Creative Thinking, Norms - Technical - Manual, p. 61

Table 9

VERBAL TOTAL (1)

	Difference Mean	Standard Deviation	T Value	2 - Tail Prob.	
Groupe A	7.3333	6.0782	2.70	.054	S
Groupe B	- 5.5555	9.2297	- 1.47	.200	N.S.
Groupe C	5.2778	6.0936	2.12	.087	N.S.
Groupe D	- 3.3333	10.633	- .07	.947	N.S.

S ≤ .055

(1) Standardized scores .

Table 10

TOTAL VERBAL AND FIGURAL (1)

	Difference Mean	Standard Deviation	T Value	2 - Tail Prob.	
Groupe A	4.7916	5.9877	1.79	.148	N.S.
Groupe B	1.5972	3.8048	1.03	.351	N.S.
Groupe C	8.4303	7.4993	2.75	.040	S.
Groupe D	3.4583	8.2582	.94	.402	N.S.

S ≤ .055

(1) Standardized scores .

If the post-test is compared to the pre-test for the group trained in visual afterimage mixing, there is no significant difference between any of the subtests taken individually.(table 7).However, there is a significant difference in the verbal aspect seen as a whole (table 9).

As for the group trained in the idea-stimulating techniques, there are significant differences in the figural fluency and originality. The group trained in both idea-stimulating techniques and visual afterimage shows significant difference only on figural elaboration when the subtests are considered individually (table 7). However, the difference between the pre-test and the post-test is big enough to indicate a significant difference in the figural total as well as in the grand total (tables 8 & 10).

The post-test—pre-test comparison for the experimental groups put together shows improvement particularly on the figural aspect of creativity. However, the fact that the figural aspect improved to a certain extent (but not significantly) in the control group must also be considered.

Finally, the last table shows that in the grand total, only the group that had training in both visual afterimage mixing and idea-stimulating techniques improved its creativity as a whole (both verbal and figural).

3.2.2 Interpretation of the Results

Certain conclusions can be drawn from these results.

A. Training with visual afterimage only.

Surprisingly, training in visual afterimage mixing seems to improve children's verbal ability, taken as a whole, but does not have much effect on figural ability.

Lefébure, the French doctor from whom the experiment draws its inspiration, uses the visual afterimage mixing to help children improve their ideational abilities. One might have expected an improvement of verbal abilities to come as a secondary effect, but not as the main effect. Does visual afterimage help children to think in images? If so, why does it not help to improve figural abilities?

Jean Houston, who describes an experiment similar to the one in this study, does not seem to imply much verbal thinking when she talks about eidetic imagery:

> Stimulating visualization: We have been able to give people access to eidetic imagery by stimulating ideo-retinal patterns with stroboscopic light, or by subjecting them to a subtle audio-visual overload from the environment which was described. The effect of the environment is to stimulate imagery centres of the brain, so that after a while the subject enters into an unconscious partnership with the forms and colors flowing in front of him and begins to project onto the screen his own previously internal imagery.

> At this point, he might shut his eyes and discover that the show is continuing. (1)

It seems that Houston's experiment as well as the one presented before induce what McKim, talking about visual thinkery, calls "relaxed attention".

> Relaxed attention is closely allied to meditation techniques, which are increasingly being interwoven with Creative Studies. (2)

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(1) Jean Houston, "The Psychenaut Program: An Exploration into Some Human Potentials," Guide to Creative Action, p. 237.

(2) R. H. McKim, "Relaxed Attention," Guide to Creative Action, p. 206.

B. Training with Idea-stimulating Techniques.

Like the experiments recounted in the "Summary of experiments involving Osborn-Parnes creative problem-solving training and/or modifications", the training that children had in this experiment in idea production "achieved some degree of success". (1) However, with reference to this summary, the results are far less satisfactory than might have been expected. There are at least two reasons for this. First, there were twice as many boys as girls in the group trained in idea-stimulating techniques, and, unlike the girls who were involved in the study, they felt absolutely free to come or not to come to the training every day, so that they missed more training sessions than the girls. Since boys performed less well than girls on the post-test, the mean of the group trained in idea-stimulating techniques is probably lowered by the fact there are more boys than girls in the group.

Second, the children in this group really enjoyed playing with ideas during the training sessions. They hitch-hiked easily, and their flow of ideas was beautiful. Most of the time the training was done verbally, and the children worked as a group. When they were told they would be asked to take the tests again, theysaid, "Oh! Non!"--visibly annoyed. Since "motivation is indisputably

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(1) E. P. Torrance, "Can We Teach Children to Think Creatively?" Assessing Creative Growth, pp.

important in creative thinking, it is to be expected that motivational conditions affect test—retest reliability. (1)

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(1) E. P. Torrance, Torrance Tests of Creative Thinking, Norms-Technical Manual, p. 22.

C. Training with Visual Afterimage Mixing and Idea-stimulating Techniques.

The group that had this training improved its creativity significantly, especially in the figural dimension. There are several possible explanations for these results: firstly, this group had almost twice as much training as the other two experimental groups; secondly, all the children but one in this group were girls, and girls performed much better on the post-test than boys; thirdly, idea-stimulating techniques and visualization techniques like visual afterimage mixing could be a good combination for enhancing creativity. Don Taylor is heading in this direction when he writes:

> The Functional Visualization is accomplished by first visualizing the performance of needed functions without the use of hardware, occurring as if by magic. Then, necessary hardware is added very gradually through creative interpretation until a completed solution emerges. Because of its conceptual nature, this approach also enables existing creative techniques such as brainstorming, checklists, and bionics to be utilized more successfully. (1)

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(1) D. Taylor,"Creative Design through Functional Visualization," The Journal of Creative Behavior, 1963, vol. 3, no. 2, p. 127.

3.2.3 Extent of the Study

Even though this study was done seriously, a few problems that occurred during the experiment due to the peculiar conditions of a daycamp limit its scope.

1° The sampling was small (22 at the end of the experiment).

2° The experiment was short (two weeks).

3° The setting was different from the one children are used to at school.

4° The type of activities in the daycamp probably influenced the results on post-tests since the children did a lot of drawing but did not write as much as they usually do in school.

As far as testing instruments are concerned, it might have been preferable to use more than one battery of tests, especially since Torrance Tests of Creative Thinking are, as Laurence Rieben points out, very much in correlation with the operatory level (referring to Piaget stages) as well as being in correlation with the performance part of the Wisc. (1)

In spite of these limitations, this experiment can give valuable indications as far as training in creativity is concerned, especially when it is done within a short period of time. In fact, the experiment shows that idea-stimulating techniques become much more effective when combined with visualization techniques.

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(1) Laurence Rieben, Intelligence et pensée créative, op. cit.

CONCLUSION

In this research it has been demonstrated that visual after-image mixing is a valuable technique for improving creativity, especially the verbal aspect. Moreover, when combined with idea-stimulating techniques, creativity as a whole is improved. For sure, these conclusions must be considered within the limitations of the study. However, they seem to confirm the present tendency to introduce visualization techniques into creative problem-solving programs, a tendency illustrated in the Guide for Creative Action.

As Torrance says, "Teaching internal visualization /. . ./ will be needed in the future to help children cope with their fast-paced, rapidly changing society." (1)

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(1) The Search for Satori E Creativity, p. 173.

BIBLIOGRAPHY

Amégan, K.S., Etude du retentissement de l'organisation pédagogique sur le développement de la pensée créative au niveau de l'école élémentaire, Université libre de Bruxelles, Bruxelles, 1977, 406 p.

Anstis, S., Rogers, B., Henry, J., "Interactions between Simultaneous Contrast and Coloured Afterimages", Vision Research, 1978, vol. 18, no. 8, pp. 899-911.

Barry, R.J., Beh, Helen, C., "EEG Correlates of the Afterimage of Visual Stimulation", Psychophysiology, 1976, Jan., vol. 13, no. 1, pp. 75-80.

Biondi, A.M., Parnes, S.J., Assessing Creative Growth, The Tests - Book One - Creative Synergetic Associates, Great Neck, 1976, 122 p.

Biondi, A.M., Parnes, S.J., Assessing Creative Growth, Measured Changes - Book Two - Creative Synergetic Associates, Great Neck, 1976, 261 p.

Bonnel, C., "Le conditionnement sensori-sensoriel dans les analyseurs visuels d'attributs", Psychologie française, 1975, T. 20, no. 1-2, pp. 35-43.

Dayhaw, L.T., Manuel de statistique, Ed. de l'Université d'Ottawa, Ottawa, 1963, 530 p.

Ditchburn, R.W., Drysdale, A.E., "Visual Information Obtained from Flashes and from Afterimages", Vision Research, 1973, Dec., vol. 13, no. 12, pp. 2435-2447.

Dunn-Rankin, P., "Using After Images in the Analysis of Letter and Word Focalization", Journal of Reading Behavior, 1977, vol. 9, no. 2, pp. 113-122.

Durio, Helen, F., "Mental Imagery and Creativity", The Journal of Creative Behavior, vol. 9, no. 4, fourth quarter, 1975, pp. 233-244.

Gowan, J.C., "The Facilitation of Creativity through Meditational Procedures", The Journal of Creative Behavior, vol. 12, no. 3, third quarter, 1978, pp. 156-160.

Gowan, J.C., "The Production of Creativity through Right Hemisphere Imagery", The Journal of Creative Behavior, vol. 13, no. 1, first quarter, 1979, pp. 39-51.

Hill, L.A., Silverman, W.P., "Visual Perseveration in Normal and Mentally Retarded Children", Perceotual and Motor Skills, 1978, Feb., vol. 46, no. 1, pp. 55-62.

Kaylor, Catherine W., Davidon, Robert, S., "Accuracy of Recall as a Function of Eidefic Imagery", Perceptual and Motor Skills, 1979, 48, pp. 1143-1148.

King, S.P., Riggs, L.A., Moore, R.K., Butler, T.W., "Temporal Properties of the Human Visual Nervous System", Vision Research, 1977, vol. 17, no. 9, pp. 1101-1106.

Lefebure, F., L'Exploration du cerveau par l'alternance des phosphènes doubles, A.C.D.L., Montréal, / 1977. /

Lefebure, F., Le mixage phosphénique en pédagogie, A.C.D.L., Montréal, 1978, 253 p.

Lefebure, F., Phosphénisme et origine des religions, 2e édition, A.C.D.L., Montréal, 1980.

Lindsay, N., Traitement de l'information et comportement humain, une introduction à la psychologie, Éd. vivantes, St-Laurent, 1979.

Masters, R., Houston, Jean, Mind Games, Delta, 1972, 246 p.

Nie, H.N., Hull, H.C., Jenkins, Jean, Stein Brenner, Karin, Bent, D.H., Statistical Package for the Social Sciences, McGraw-Hill, U.S.A., 1970, 675.

Olton, R.M., "Experimental Studies of Incubation: Searching for the Elusive", The Journal of Creative Behavior, vol. 13, no. 1, first quarter, 1979, pp. 9-22.

Parnes, S.J., Noller, Ruth, B., Biondi, A.M., Guide to Creative Action, Charles Scribner's Sons, New York, 1977, 399 p.

Rieben, Lawrence, Intelligence et pensée créative, Delachaux & Niestlé, Neuchâtel, 1978, 162 p.

Sauret, M.-J., Schützenberger, Le corps et le groupe, Privat, Toulouse, 1977, 335 p.

Selltiz, Claire, Jahoda, Marie, Deutsch, M., Cook, S.T., Statistical Methods in Social Relations, Holt, Rinehart, Winston, 1963, 622 p.

Skowbo, D., Timney, B.N., Gentry, T.A., Morant, R.B., "Mc Collough Effects: Experimental Findings and Theoretical Accounts", Psychological Bulletin, 1975, vol. 82, no. 4, pp. 497-510.

Smith, G.J., Sjoholm, Lena, Anderson, A.L., "Effects of Extraneous Stimulation on Afterimage Adaptation", Psychological Research Bulletin, 1970, vol. 10, no. 7, 10 p.

Smith, G.J., Ruuth, E., Franzen, G., Sjoholm, Lena, "Intermittent Regressions in a Serial Afterimage Experiment as Signs of Schizophrenia", Psychological Research Bulletin, 1971, vol. 11, no. 4, 13 p.

Smith, G.J., Sjoholm, Lena, "The Effects on the Production of Visual Afterimages of Two Different Percept - Involved Afterimage Theories in Interaction with the Subject's Defensive System", Psychological Research Bulletin, 1972, vol. 12, no. 11, 18 p.

Smith, G.J., Sjoholm, Lena, Nielzen, S., "Explorations in Anxiety and Defensive against Anxiety by Means of Two Percept-genetic Techniques", Psychological Research Bulletin, 1973, vol. 13, no. 2, 21 p.

Smith, G.J., Sjoholm, Lena, "Can your Theory of Reality Influence our Perception of It", Psychological Research Bulletin, 1974, mono series no. 1, 27 p.

Taylor, D., "Creative Design through Visualization", The Journal of Creative Behavior, 1969, vol. no. 2, pp. 122-127.

Torrance, E.P., The Search for Satori E Creativity, Creative Education and Creative Synergetic Associates, Great Neck, 1979, 219 p.

Torrance, E.P., Tests de pensée créative, Centre de psychologie appliquée, Paris, 1972, 37 p.

Torrance, E.P., Tests of Creative Thinking, Norms - Technical Manual - Verbal Tests, Forms A and B, Figural Tests, Forms A and B, Personnel Press, Princeton, 1966, 95 p.

Torrance, E.P., Torrance Tests of Creative Thinking, Figural Tests, Form A, Personnel Press, Princeton, 1966, 43 p.

Torrance, E.P., Torrance Tests of Creative Thinking, Verbal Tests, Form A, Personnel Press, Princeton, 1966, 51 p.

Torrance, E.P., "An Instructional Model for Enhancing Incubation", The Journal of Creative Behavior, vol. 13, no. 1, first quarter, 1979, pp. 23-25.

Wade, N.J., "Why Do Patterned Afterimages Fluctuate in Visibility?, Psychological Bulletin, 1978, vol. 85, no. 2, pp. 338-352.

Walkup, L.E., "Creativity in Science through Visualization", The Journal of Creative Behavior, 1967, vol. 1, no. 3, pp. 283-290.

Wenger, W., Honey Wenger Suzan, Applying the Holographic Principle to the Scientific Investigation of Dynamic Systems, Psychegenics, 1978, 20 p.

Wenger, W., Beyond O.K., Psychegenic Tools Relating to Health of Body and Mind, Psychegenics, Gaithersburg, 1979, 239 p.

Wenger, W., Creative Creativity - A new Generation of Methods for Getting the Best Answer - in an Immediate Flash, Psychogenics, 1980, 27 p.

Have an Affair with Your Mind, The Creative Education Foundation, 1974, 48 p.

APPENDIX I

INTERGROUP COMPARISON BETWEEN POST-TESTS

I- Picture construction
2- Figure completion
3- Repeated closed figures

A= Visual after-image
B= Idea-Stimulating techniques
C= Idea-Stimulating techniques & Visual after-image
D= Control

FIGURAL TEST

	A	B	A	C	A	D	B	C	B	D	C	D
FLUENCY												
I	✓											
2	✓		–	–	✓			✓		✓		
3		✗		✗	✗			✗	✗		✗	
FLEXIBILITY												
I												
2	✗		✗		✗		—	—		✗		✗
3		✓		✗	✓			✓	✓		✗	
ORIGINALITY												
I	✗		✓		✗		✗		✓		✗	
2	✓			✓	✗			✓		✗	✗	
3	✓			✗	✓			✗	✓		✗	
ELABORATION												
I	✓		✗		✗			✓	✓		✓	
2	✓		✗		✓		—	—	✗		✗	
3		✗		✗	✗			✗	✗		✗	
TOTAL	7/10	3/10	4/10	5/10	10/10	0/10	/10	/10	7/10	3/10	9/10	1/10

✗ : larger improvement

INTERGROUP COMPARISON BETWEEN POST-TESTS

1- Asking questions
2- Guessing causes
3- Guessing consequences
4- Product improvement
5- Unusual uses
6- Just suppose

A= Visual after-image
B= Idea-Stimulating techniques
C= Visual after-image & Idea-Stimulating techniques
D= Control

VERBAL TEST

	A	B	A	C	A	D	B	C	B	D	C	D
FLUENCY												
1		x		x	x			x	x		x	
2	x		x		x			x	x		x	
3	x			x	x			x		x	x	
4	x			x	x			x	x		x	
5	x		x		x			x	x		x	
6	x			x	x			x	x		x	
FLEXIBILITY												
1	x			x	x			x		x	x	
2	x			x	x			x	x		x	
3	x			x				x	x		x	
4	x		—	—	x			x		x	x	
5	x			x	x			x		x	x	
6	x			x	x	x		x		x	x	
ORIGINALITY												
1	x		x		x			x	x		x	
2	x		x		x			x	x		x	
3	x			x	x			x		x	x	
4	x			x	x			x	x		x	
5	x		x		x			x		x	x	
6	x			x	x			x	x		x	
TOTAL:	17/18	1/18	5/18	12/18	17/18			18/18	11/18	7/18	13/18	

'x' larger improvement

APPENDIX II

COMPARISON BETWEEN PRE-TEST AND POST-TEST

I: Picture construction
2: Figure completion
3: Repeated closed figure

FIGURAL TEST

	Visual After-image Mixing		Idea-Stimulating Techniques		Visual After-image Mixing & Idea stimulating Techniques		Control	
FLUENCY	pre-test	post-test	pre-test	post-test	pre-test	post-test	pre-test	post-test
I								
2		x	x			x	x	
3		x		x		x	x	
FLEXIBILITY								
I								
2		x	x			x	x	
3		x		x		x	x	
ORIGINALITY								
I		x		x		x	x	
2		x	x			x		x
3		x		x		x	x	
ELABORATION								
I		x		x		x		x
2	x		x			x		x
3	x			x		x		x
TOTAL:	2/10	8/10	4/10	6/10	0/10	10/10	4/10	6/10

x : larger improvement

COMPARISON BETWEEN PRE-TEST AND POST-TEST

I: Asking questions
2: Guessing causes
3: Guessing consequences
4: Product improvement
5: Unusual uses
6: Just suppose

VERBAL TEST

	Visual After-image Mixing		Idea-Stimulating Techniques		Visual After-image Mixing &Idea-stimulating Techniques		Control	
FLUENCY	pre-test	post-test	pre-test	post-test	pretest	post-test	pre-test	post-test
I	x			x		x		
2		x	x			x		
3		x	x			x		
4		x	x			x		x
5		x	x		x			
6		x	x			x		x
FLEXIBILITY								
I	x		x			x		
2		x	x			x		
3			x			x		
4	x		x		x			
5	x		x		x			
6		x	x			x		x
ORIGINALITY								
I	x			x		x		
2		x	x			x		
3		x	x			x		x
4		x	x			x		x
5		x	x			x		
6		x	x		x			x
TOTAL:	6/18	12/18	16/18	2/18	4/18	14/18	12/18	6/18

x : larger improvement